

introduced in the pending claims. Applicants request further examination of the application in view of the foregoing amendment and the following remarks.

III. Rejection of claims 22, 24, and 26 under 35 U.S.C. §102(b)

The Examiner has rejected claims 22, 24, and 26 under §102(b) as being anticipated by U.S. Patent 5,669,341 to Ushirono et al.

Claim 22, as filed, failed to include a limitation that was intended by Applicants. This error occurred in the process of transforming the file into the form required for electronic filing. Applicants submit that Ushirono et al. fail to show "actuating the valve according to a first mode when a first set of engine operating conditions are detected, said first mode further comprises the steps of de-energizing the valve closing electromagnet; maintaining the valve closing electromagnet in said de-energized state for a first predetermined time enabling the valve to oscillate by force of the valve opening spring and the valve closing spring; and energizing the valve closing electromagnet after said first predetermined time to close the valve." The limitation of Applicants' amended claim 22 was erroneously missing in the application as filed.

Based on the amendment to claim 22, Applicants submit that claim 22 is in allowable condition. Applicants further submit that claims 24 and 26, which depend from claim 22, are also not anticipated by Ushirono et al. Withdrawal of the rejections to claims 22, 24, and 26 is courteously requested.

IV. Objection to claims 23 and 25

The Examiner has objected to claims 23 and 25 as being dependent upon a rejected base claim. Applicants submit that claims 22 and 24 are now in allowable condition and request that the objection to claims 23 and 25 be withdrawn.

V. Amendment to claim 7.

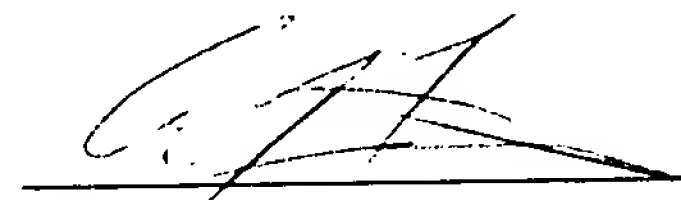
Claim 7, as filed depended from claim 2. However, claim 2 did not provide antecedent basis for "said valve period." Applicants have amended claim 7 so that it properly depends from claim 4, in which "a valve period " is introduced.

VI. Conclusion

No other art is cited in the Office Action. Based on the foregoing comments, the above identified application is believed to be in condition for allowance, and such allowance is courteously solicited. The Examiner is requested to contact the undersigned by fax or telephone at the number listed below for further information.

Please charge any cost incurred in the filing of this Amendment, along with any other costs, to Deposit Account 06-1510. If there are insufficient funds in this account, please charge the fees to Deposit Account No.06-1505.

Respectfully submitted,



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Specification Amendments Pursuant to 37 CFR 1.121(b)(iii)

Redline/strikeout version of amended specification:

Abstract

A system and method are disclosed for controlling electromechanical intake valves disposed in the cylinder head of an internal combustion. The electromechanical valve system has a valve closing electromagnet capable of exhibiting an electromagnetic force for attracting the armature to close the valve, a valve opening electromagnet capable of exhibiting an electromagnetic force for attracting the armature to open the valve, a valve opening spring for biasing the armature in a direction to open the valve, and a valve closing spring for biasing the armature in a direction to close the valve. The method includes the steps of de-energizing the valve closing electromagnet, maintaining the valve closing electromagnet in the de-energized state for a predetermined time enabling the valve to oscillate by force of the valve opening spring and the valve closing spring, and energizing the valve closing electromagnet after the predetermined time to

close the valve. By the method of the present invention, only the valve closing electromagnet need be energized in causing the valve to open and close. The method relies on the valve biasing springs to cause the valve to return to a location in which the valve closing magnet can actuate the valve closed. Prior methods require that both the valve opening electromagnet and the valve closing electromagnet be actuated to open and close the valve. The present invention provides an electrical energy savings compared to prior methods.

Claim Amendments Pursuant to 37 CFR 1.121(c)(1)(ii)

Redline strikeout version of claims:

7. (amended) The method of claim ~~42~~, wherein said valve period is based on the spring constant of the valve opening spring, the spring constant of the valve closing spring, a mass of the valve, and a mass of the armature, and damping coefficients of the valve opening spring, the armature, and the valve.

22. (amended) A method for actuating an intake valve disposed in a cylinder head of an internal combustion engine by an electromagnetic valve apparatus having a valve closing electromagnet capable of exhibiting an electromagnetic force for attracting the armature to close the valve, a valve opening electromagnet capable of exhibiting an electromagnetic force for attracting the armature to open the valve, a valve opening spring for biasing the armature in a direction to open the valve, a valve closing spring for biasing the armature in a direction to close the valve, comprising the steps of:

actuating the valve according to a first mode when a first set of engine operating conditions are detected, said first mode further comprises the steps of de-energizing the valve closing electromagnet; maintaining the valve closing electromagnet in said de-energized state for a first predetermined time enabling the valve to oscillate by force of the valve opening spring and the valve closing spring; and energizing the valve closing electromagnet after said first predetermined time to close the valve;
and

actuating the valve according to a second mode when a second set of engine operating conditions are detected, said second mode further comprises the steps of de-energizing the valve closing electromagnet to allow the valve to open, energizing the valve opening electromagnet in response to said de-energizing step to attract the

armature to the valve opening electromagnet thereby causing the valve to open; de-energizing the opening electromagnet after a second predetermined time has elapsed since the valve opening electromagnet has been energized; and energizing the valve closing electromagnet in response to said de-energizing step of the valve opening electromagnet to attract the armature to the valve closing electromagnet thereby causing the valve to close.

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energizing electromagnet after a second predetermined time has
elapsed opening electromagnet has been energized; and energizing
electromagnet in response to said de-energizing step of the valve
electromagnet to attract the armature to the valve closing electromagnet
valve to close.